

Applicant: Wasserscheid et al.
Filing Date: March 11, 2004

Amendments to the Claims

Docket No. VSKW-1

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Claims

We claim the following:

- 1) (Currently Amended) A Method of using ~~Use of~~ a compound of the Formula 1 in a process,

(cation)(R'SO₄)

Formula 1

comprising the step of: employing the compound as a solvent, solvent additive, or extraction solvent; employing the compound as a heat carrier, or heat carrier additive; or employing the compound as a phase transfer catalyst, wherein:

R' is selected from the group consisting of a linear or branched, saturated or unsaturated, aliphatic or alicyclic, functionalized or non-functionalized alkyl radical with 3-36 carbon atoms, wherein R' is optionally functionalized with one or more X groups; X is selected from the group consisting of an -OH, -OR'', -COOH, -COOR'', -NH₂, -SO₄, -F, -Cl, -Br, -I or -CN; and R'' is selected from the group consisting of a branched or linear hydrocarbon chain with 1 - 12 carbon atoms; and

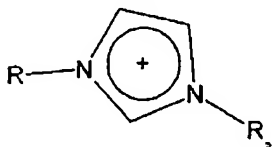
the compound has melting point of less than 100° C.

- 2) (Currently Amended) The ~~use~~ method of claim 1, wherein the cation is a nitrogen-containing cation selected from the group consisting of a quaternary ammonium cation, an imidazolium cation, a pyridinium cation, a pyrazolium cation, and a triazolium cation.

- 3) (Currently Amended) The ~~use~~ method of claim 1, wherein the cation is selected from the group consisting of:

- quaternary ammonium cation with the general formula (NR₁R₂R₃R)⁺;
- phosphonium cation with the general formula (PR₁R₂R₃R)⁺;
- imidazolium cation with the general formula

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in which the imidazole core is optionally substituted with at least one group selected from C₁-C₆ alkyl group, C₁-C₆ alkoxy group, C₁-C₆ aminoalkyl group, C₅-C₁₂ aryl group or C₅-C₁₂-aryl-C₁-C₆ alkyl group;

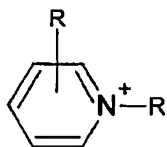
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d) pyridinium cation with the general formula

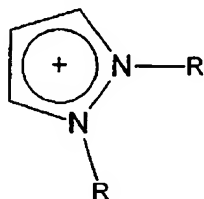
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5 in which the pyridine core is optionally substituted with at least one group selected from C₁-C₆ alkyl group, C₁-C₆ alkoxy group, C₁-C₆ aminoalkyl group, C₅-C₁₂ aryl group or C₅-C₁₂-aryl-C₁-C₆ alkyl group;

e) pyrazolium cation with the general formula

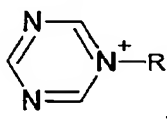
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10 in which the pyrazole core is optionally substituted with at least one group selected from C₁-C₆ alkyl group, C₁-C₆ alkoxy group, C₁-C₆ aminoalkyl group, C₅-C₁₂ aryl group or C₅-C₁₂-aryl-C₁-C₆ alkyl group; and

f) triazolium cation with the general formula

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in which the triazole core is optionally substituted with at least one group selected from C₁-C₆ alkyl group, C₁-C₆ alkoxy group, C₁-C₆ aminoalkyl group, C₅-C₁₂ aryl group or C₅-C₁₂-aryl-C₁-C₆ alkyl group; wherein

20 g) the radicals R¹, R², R³ are selected independently at each occurrence from the group consisting of:

i) hydrogen;

ii) linear or branched, saturated or unsaturated, aliphatic or alicyclic alkyl groups with 1

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to 20 carbon atoms;

iii) heteroaryl groups, heteroaryl-C₁-C₆ alkyl groups with 3 to 8 carbon atoms in the heteroaryl radical and at least one heteroatom selected from N, O and S which is optionally substituted with at least one group selected from C₁-C₆ alkyl groups and/or halogen atoms;

iv) aryl, aryl-C₁-C₆ alkyl groups with 5 to 12 carbon atoms in the aryl radical, which is optionally substituted with at least one C₁-C₆ alkyl group and/or a halogen atom; and

h) the radical R is selected from the group consisting of:

i) linear or branched, saturated or unsaturated, aliphatic or alicyclic alkyl groups with 1 to 20 carbon atoms;

ii) heteroaryl-C₁-C₆ alkyl groups with 3 to 8 carbon atoms in the aryl radical and at least one heteroatom selected from N, O and S, which is optionally substituted with at least one C₁-C₆ alkyl group and/or halogen atom; and

iii) aryl-C₁-C₆ alkyl groups with 5 to 12 carbon atoms in the aryl radical, which is optionally substituted with at least one C₁-C₆ alkyl group and/or halogen atom.

4) (Currently Amended) The ~~use~~ method of claim 1, wherein the anion has an empirical formula selected from the group consisting of C₄H₉SO₄, C₈H₁₇SO₄ or C₁₂H₂₅SO₄.

5) (Currently Amended) The ~~use~~ method of claim 1, wherein the compound of the Formula 1 has a melting point of less than 75 C.

6) (Currently Amended) The ~~use~~ method of claim 1, wherein the compound of the Formula 1 has a melting point of less than 50 C.

7) (Currently Amended) The ~~use~~ method of claim 1, wherein (R'SO₄) is an alkyl sulfate ester, wherein the alkyl moiety is selected from the group consisting of butyl, octyl, 2-ethylhexyl, and dodecyl.

8) (Currently Amended) The ~~use~~ method of claim 7, wherein the cation is a nitrogen containing cation selected from the group consisting of 1-ethyl-3-methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium, 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium, trioctylmethylammonium, trimethyldecylammonium, and trihexyltetradecylphosphonium.

9) (Currently Amended) The ~~use~~ method of claim 1, wherein the cation is a nitrogen containing

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cation selected from the group consisting of 1-ethyl-3-methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium, 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium, trioctylmethylammonium, trimethyldecylammonium, and trihexyltetradecylphosphonium.

10) (Currently Amended) The use method of claim 1, wherein the compound of the Formula 1 is used in a reaction catalyzed by a transition metal.

11) (Currently Amended) The use method of claim 10, wherein the compound of the Formula 1 is used in a hydroformylation reaction, oligomerization reaction, esterification reaction, isomerization reaction or amide bond-forming reaction.

12) (Currently Amended) The use method of claim 1, wherein the compound of the Formula 1 is used in a reaction catalyzed by an enzyme or biocatalyst.

13) (Currently Amended) The use method of claim 12, wherein the compound of the Formula 1 is used in an oligomerization reaction, C-C bond-forming reaction, esterification reaction, isomerization reaction, or amide bond-forming reaction.

14) (Currently Amended) The use method of claim 1, wherein the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous solution (pH = 7) up to 80 °C.

15) (Currently Amended) The use method of claim 1, wherein the compound of the Formula 1 has a melting point of less than 25 °C.

16) (Currently Amended) The use method of claim 1, wherein the compound is selected from the group consisting of:

- a) 1-ethyl-3-methylimidazolium butyl sulfate;
- b) 1-ethyl-3-methylimidazolium octyl sulfate;
- c) 1-ethyl-3-methylimidazolium 2-ethylhexyl sulfate;
- d) 1-ethyl-3-methylimidazolium dodecyl sulfate;
- e) 1-butyl-3-methylimidazolium butyl sulfate;
- f) 1-butyl-3-methylimidazolium octyl sulfate;
- g) 1-butyl-3-methylimidazolium 2-ethylhexyl sulfate;
- h) 1-butyl-3-methylimidazolium dodecyl sulfate;
- i) 1-hexyl-3-methylimidazolium butyl sulfate;
- j) 1-hexyl-3-methylimidazolium octyl sulfate;

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- k) 1-hexyl-3-methylimidazolium 2-ethylhexyl sulfate;
- l) 1-hexyl-3-methylimidazolium dodecyl sulfate;
- m) 1-octyl-3-methylimidazolium butyl sulfate;
- n) 1-octyl-3-methylimidazolium octyl sulfate;
- 5 o) 1-octyl-3-methylimidazolium 2-ethylhexyl sulfate;
- p) 1-octyl-3-methylimidazolium dodecyl sulfate;
- q) 1-decyl-3-methylimidazolium butyl sulfate;
- r) 1-decyl-3-methylimidazolium octyl sulfate;
- s) 1-decyl-3-methylimidazolium 2-ethylhexyl sulfate;
- 10 t) 1-decyl-3-methylimidazolium dodecyl sulfate;
- u) 1-dodecyl-3-methylimidazolium butyl sulfate;
- v) 1-dodecyl-3-methylimidazolium octyl sulfate;
- w) 1-dodecyl-3-methylimidazolium 2-ethylhexyl sulfate;
- x) 1-dodecyl-3-methylimidazolium dodecyl sulfate;
- 15 y) 1-butyl-pyridinium butyl sulfate;
- z) 1-butyl-pyridinium octyl sulfate;
- aa) 1-butyl-pyridinium 2-ethylhexyl sulfate;
- bb) 1-butyl-pyridinium dodecyl sulfate;
- cc) trimethyldecylammonium butyl sulfate;
- 20 dd) trimethyldecylammonium 2-ethylhexyl sulfate;
- ee) trioctylmethylammonium butyl sulfate;
- ff) trioctylmethylammonium octyl sulfate;
- gg) trioctylmethylammonium 2-ethylhexyl sulfate;
- hh) trioctylmethylammonium dodecyl sulfate;
- 25 ii) trimethyldecylammonium butyl sulfate;
- jj) trimethyldecylammonium octyl sulfate;
- kk) trihexyltetradecylphosphonium butyl sulfate;
- ll) trihexyltetradecylphosphonium octyl sulfate;
- mm) trihexyltetradecylphosphonium 2-ethylhexyl sulfate;
- 30 nn) trihexyltetradecylphosphonium dodecyl sulfate.

17) (Currently Amended) Use of A method of using a compound of the Formula 1 in a process

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(cation)(R'SO₄)

Formula 1

comprising the step of: employing the compound as a solvent, solvent additive, or
extraction solvent;; employing the compound as a heat carrier, or heat carrier additive;; or
5 employing the compound as a phase transfer catalyst, wherein:

R' is selected from the group consisting of a linear or branched, saturated or unsaturated,
aliphatic or alicyclic, functionalized or non-functionalized alkyl radical with 3-36 carbon atoms,
wherein R' is optionally functionalized with one or more X groups; X is selected from the group
consisting of an -OH, -OR'', -COOH, -COOR'', -NH₂, -SO₄, -F, -Cl, -Br, -I or -CN; and R'' is
10 selected from the group consisting of a branched or linear hydrocarbon chain with 1 - 12 carbon
atoms;

the compound has melting point of less than 100° C;

the cation is a nitrogen-containing cation selected from the group consisting of a
quaternary ammonium cation, an imidazolium cation, a pyridinium cation, a pyrazolium cation,
15 and a triazolium cation;

the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous
solution (pH = 7) up to 80 °C.

18) (Currently Amended) The ~~use~~ method of claim 17, wherein the anion has an empirical
formula selected from the group consisting of C₄H₉SO₄, C₈H₁₇SO₄ or C₁₂H₂₅SO₄.

20 19) (Currently Amended) ~~Use of A~~ method of using a compound of the Formula 1 in a process

(cation)(R'SO₄)

Formula 1

comprising the step of: employing the compound as a solvent, solvent additive, or
extraction solvent;; employing the compound as a heat carrier, or heat carrier additive;; or
25 employing the compound as a phase transfer catalyst, wherein:

- a) (R'SO₄) is an alkyl sulfate ester, wherein the alkyl moiety is selected from the group
consisting of butyl, octyl, 2-ethylhexyl, and dodecyl;
- b) the cation is a nitrogen containing cation selected from the group consisting of 1-ethyl-3-
methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium,
30 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-
methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium,
triocylmethylammonium, trimethyldecylammonium, and

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trihexyltetradecylphosphonium;

- c) the compound has melting point of less than 100° C; and
- d) the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous solution (pH = 7) up to 80 °C.

5 20) (Currently Amended) The ~~use~~ method of claim 19, wherein the ~~compound of the Formula 1~~
~~is used in process~~ is a reaction catalyzed by a transition metal, and the reaction is a
hydroformylation reaction, oligomerization reaction, esterification reaction, isomerization
reaction or amide bond-forming reaction.

10 21) (Currently Amended) The ~~use~~ method of claim 19, wherein the ~~compound of the Formula 1~~
~~is used in process~~ is a reaction catalyzed by an enzyme or biocatalyst, and the reaction is an
oligomerization reaction, C-C bond-forming reaction, esterification reaction, isomerization
reaction, or amide bond-forming reaction.